

## STS-111 Flight Readiness Review (FRR) Minutes

The STS-111 FRR convened at 10:30 a.m. on Thursday, May 16, 2002, in the Mission Briefing Room at the Kennedy Space Center. The meeting was chaired by F. Gregory, Associate Administrator, Office of Space Flight.

Flight Crew, Ferry Readiness, Range, and DDMS did not have any issues or constraints to flight and did not make formal presentations. Readiness statements submitted were included in the backup package.

The STS-111 FRR presenters were:

Mission Operations - R. Castle (NASA/JSC/DA8)

P. Hill (NASA/JSC/DA8)

T. Sobchak (NASA/GSFC/451)

R. Gest (USA/Houston/USH-421N)

Extra Vehicular Activity - T. Jochim (Hamilton Sunstrand/JSC/XA)

Space and Life Sciences - C. Fischer (NASA/JSC/SD)

Program Integration - R. Adams (NASA/JSC/MA2)

R. White (USA/Houston/USH-700C)

R. Wallace (NASA/JSC/MS2)

International Space Station - B. Dickey (NASA/JSC/OC)

S. Walker (NASA/JSC/OB)

B. Pawlik (NASA/JSC/OZ)

W. Mackey (CSA/JSC/OR-CSA)

Payload Processing - G. Chin (NASA/KSC/UB-M)

External Tank - M. Quiggle (LMSSC/MAF/4250)

Reusable Solid Rocket Motor - T. Boardman (Thiokol/Utah/L00)

Solid Rocket Booster - R. Wright (USA/KSC/USK-840)

Space Shuttle Main Engine - D. Wineland (Rocketdyne/Canoga Park/AC38)

Vehicle Engineering - R. Roe (NASA/JSC/MV)

D. White (USA/Houston/USH-601M)

Shuttle Processing - J. Vevera (USA/KSC/USK-229)

C. Connolly (USA/KSC/USK-459)

B. McCain (USA/KSC/USK-290)

M. Leinbach (NASA/KSC/PH)

Safety Reliability & Quality Assurance - M. Erminger (NASA/JSC/MQ)

### Mission Operations

The second mission utilization flight (UF-2) in the International Space Station assembly sequence will rotate Expedition 4/5 crews, fly the multi-purpose logistics module (MPLM) for critical cargo transfer, and perform three extravehicular activities. Mission requirements, integrated network activity, facility readiness, flight rule changes, and ascent performance were presented.

### Extravehicular Activity (EVA)

Three scheduled EVA's from the space station joint airlock will transfer the power data grapple fixture to the P6 truss, stow service module debris panels on pressurized mating adapter 1, install the mobile servicing system on the mobile transporter, and replace the wrist roll joint on the station remote manipulator system.

### Space and Life Sciences

Status was given on crew health, detailed supplementary objectives, crew work/rest cycle violations, radiation analysis, and dosimetric support.

### Program Integration

A 12-day mission has been baselined. One non-compliance report regarding the biomass production system pinch point hazard on the integrated station express rack was approved. Systems integration postflight data reconstruction revealed lower than predicted main engine mixture ratio and higher specific impulse on the last three flights. The root cause, an input error in the controller logic equation, has been corrected. Systems Integration submitted a certificate of flight readiness exception concerning the definition and approval of identified launch commit criteria requirements as a result of the STS-110 front end processor problem.

### International Space Station (ISS)

An overview of the Increment 5 and Stage UF-2 was presented. Significant hardware elements, multi-purpose logistics module rack configurations, middeck stowage, consumables, and launch commit criteria were reviewed. Discussion included a suspected avionics box failure in the Elektron oxygen generator, contamination of the internal thermal control system fluid, and mobile transporter auto sequence failures.

### Payload Processing

Open work, pad stow schedules, and launch scrub requirements were presented. Out-of-specification MPLM main power due to changes in data reduction scaling coefficients, failed MPLM heater, and suspect loose retention hooks on the MSG video drawer umbilical are problems that will be resolved prior to launch countdown.

### External Tank (ET)

A possible foam insulation debond on ET-113 liquid oxygen feedline was documented as a significant processing anomaly due to a similar failure on another external tank. Plug pull testing on ET-113/STS-111 revealed no debonds while bond strength values indicated a factor of safety much greater than 2.0.

### Reusable Solid Rocket Motor (RSRM)

No significant discrepancies were detected during the STS-110 motor disassembly. Analysis showed no significant thrust imbalance as a result of the STS-111 left aft segment replacement. Greater-than-expected gaps between the joint pin retainer band and the clevis led to the discovery of 10 protruding pins in the right center field joint. All pins were resealed to a nominal depth or determined to be in an acceptable condition for flight with positive safety margin.

### Solid Rocket Booster (SRB)

A loose capacitor found inside the power bus isolation supply module of the integrated electronic assembly (IEA) during acceptance testing may lead to loss of power and a Criticality 1R failure. There was no evidence of a generic process failure during installation. Since all critical systems are redundant by design and the redundancy is verified during acceptance testing of all installed IEA's, similar capacitor anomalies are detectable during processing. STS-111 is safe to fly.

### Space Shuttle Main Engine (SSME)

Major components, ignition margins, predicted performance, and redline margins were presented. First-flight changes include hydraulic actuator stainless steel wireways and the new version AC39 base software. Postflight inspection of engine 2056 revealed white polyethylene contamination in numerous components. No source has yet been identified. The quantity of contamination is insignificant and does not affect engine operation. STS-111 engines have been inspected with no contamination found.

Main engine liquid oxygen flow adjustments for the main combustion chamber pressure transducer calibration coefficient were miscalculated for missions STS-108, STS-109, and STS-110. This resulted in a slightly off-nominal mixture ratio. Corrections for STS-111 have been made, and a certificate of flight readiness exception is scheduled for closure prior to the Prelaunch Mission Management Team review.

#### Vehicle Engineering

The Boeing orbiter critical skills transition process was discussed. All STS-108 and STS-110 anomalies have been addressed. Although not a constraint to the STS-111 flight, numerous reaction control system (RCS) thruster failures are the subject of a special investigation. As an additional concern related to the thruster failures, Mission Operations took an action to revalidate the technical and operational rationale for deselecting 2 of 3 forward firing jets during docking.

A critical process change documented the use of alternative parts in fuel cell power plant unitized electrode assemblies. Some of the eight modifications flying for the first time on STS-111 are: the mid-body crossover bracket redesign, multi-purpose logistics module T-0 data scar wiring, and changes to the forward RCS thermal clips and attach bolt torques.

Special topics included the external tank door power drive unit limiter low torque, an unexplained anomaly, using the same flight rationale as STS-110. Connector savers with insufficient spring force, hydraulic pump processing discrepancies, and the remote manipulator system single/direct drive switch life issue were also discussed.

#### Shuttle Processing

Late installation of the space station remote manipulator system wrist joint in the payload bay was considered a planned processing difference while the main propulsion system cavity purge nitrogen line replacement, mobile launcher platform vent line weld inspections, and T-0 umbilical connector saver replacements were unplanned activities that affected pad milestone schedules. Three in-flight anomalies were addressed: launch data base bus switching problems corrected by replacing a cable; front end processor (FEP) synchronization errors due to radio frequency data interruptions using revised, pre-planned FEP recovery procedures; and mobile launcher platform (MLP #1) hydrogen vent line weld re-certification as a result of the leak on MLP #3 during STS-110 tanking.

#### Safety, Reliability and Quality Assurance

Significant assessments have been performed on the Space Station oxygen generator repair plan, reaction control system thruster failures, power static inverter capacitor issue, front end processor anomaly, RSRM right field joint pin protrusion, and engine 2056 contamination.

#### Exceptions/Action Items

There were three certificate of flight readiness exceptions: approval of launch commit criteria associated with the front end processor anomaly (Program Integration), main engine liquid oxygen flow calibration software changes for STS-111 not yet approved by NASA Level II (SSME), and uncertified ethylene propylene rubber O-rings installed in the orbiter freon system (Orbiter). Concerning recent RCS jet failures, an action assigned to Mission Operations will revalidate the technical and operational rationale for deselecting 2 of 3 forward firing jets during docking. The three exceptions and one action item will be closed with final flight rationale at the STS-111 Prelaunch Mission Management Team meeting.

Mr. Gregory polled the principal managers and organizations; all responded ready to support the STS-111 mission.

A handwritten signature in black ink, appearing to read 'J. Halsell, Jr.', with a stylized, cursive script.

James D. Halsell, Jr.  
Colonel, USAF  
Manager, Launch Integration

Enclosures:

Agenda

Exception Log

Action Log

**STS-111**  
**Flight Readiness Review**  
**May 16, 2002**

**Agenda**

Introduction	Manager, Launch Integration
Mission Operations	Director, Mission Operations APM, Flight Operations, SFOC
EVA	Manager, EVA Project
Flight Crew	Director, Flight Crew Operations
Space and Life Sciences	Director, Space and Life Sciences
Program Integration	Flight Manager Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
International Space Station	Manager, International Space Station Program
Payload Processing	Director of ISS/Payloads Processing
External Tank	Manager, External Tank Project
RSRM	Manager, Reusable Solid Rocket Motor Project
SRB	Manager, Solid Rocket Booster Project APM, SRB Element, SFOC
SSME	Manager, Space Shuttle Main Engine Project
Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, Flight Software, SFOC APM, FCE/EVA, SFOC
Ferry Readiness	Ferry Operations Manager
Shuttle Processing	Director of Shuttle Processing APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
Range	United States Air Force
DDMS	Director, DDMS
Space Shuttle SR&QA	Manager, Safety, Reliability and Quality Assurance
Exception/Action Summaries	Manager, Launch Integration
Readiness Poll	Associate Administrator, Office of Space Flight

## CoFR EXCEPTION LOG

CoFR EXCEPTION LOG			CoFR REVIEW DATE: 05-16-02 STS FLT NO. STS-111
REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE
001	PROGRAM INTEGRATION	NSTS 08117, SECTION 8.5.12.1-b, SECTION 8.5.18.1-K LCN 1099 - LAUNCH COMMIT CRITERIA REQUIREMENTS IDENTIFIED ARE DEFINED AND APPROVED	STS-111 PMMT REVIEW
002	SSME	SSME C2 CONSTANT SOFTWARE CHANGES FOR STS-111 NOT APPROVED BY NASA LEVEL II. APPROVAL EXPECTED 05/23/2002.	STS-111 PMMT REVIEW
003	ORBITER	8.5.18.AA. ALL ANOMALIES THAT POTENTIALLY IMPACT PROCESSING, LAUNCH, MISSION SUCCESS OR LANDING HAVE BEEN REPORTED AND SUCCESSFULLY RESOLVED WITH NASA. IT HAS BEEN DETERMINED THAT UNCERTIFIED EPR O-RINGS ARE INSTALLED AT 16 LOCATIONS IN THE ORBITER FREON SYSTEM. THESE O-RINGS WERE INSTALLED AS PART OF THE APCU COLDPLATE / FREON LINE MODIFICATIONS. ALL OTHER O-RINGS IN THE FREON SYSTEM ARE NEOPRENE, WHICH IS A CERTIFIED CONFIGURATION. FURTHER EVALUATION IS REQUIRED BY ORBITER ELEMENT TO DETERMINE IF THE EPR O-RING CONFIGURATION IS ACCEPTABLE FOR STS-111.	STS-111 PMMT REVIEW

**STS-111**  
**FLIGHT READINESS REVIEW**  
**May 16, 2002**  
**ACTION ITEM LOG**

CONTROL NO.	ASSIGNEE(S)	ACTION	C	DUE DATE	CLOSURE DATE
111-FRR-001	MISSION OPERATIONS	REVALIDATE TECHNICAL AND OPERATIONAL RATIONALE FOR DESELECTING 2 OF 3 FORWARD FIRING RCS JETS DURING DOCKING AND UNDOCKING, GIVEN RECENT FLIGHT RCS JET FAILURES. REPORT RATIONALE AT THE STS-111 PRELAUNCH MMT REVIEW.		STS-111 PMMT REVIEW	